application of the magnetical influence in engineering, in tunneling, and in mining, for determining the thickness of solid masses in different situations where circumstances preclude the possibility of direct measurement. He adduces a variety of instances in which the information thus obtained would prove of the greatest value, in directing the operations in progress, or determining those to be undertaken, and frequently in preventing the occurrence of accidents which the want of such knowledge may occasion. He concludes with a statement and explanation of various practical directions for the employment of the method recommended.

A paper was read, "On a new Register Pyrometer for measuring the Expansion of Solids." Part II. By J. F. Daniell, Esq. F.R.S., Professor of Chemistry in King's College, London.

In this paper, which is a sequel to that published in the Philosophical Transactions for 1830, the author prosecutes the series of experiments he had commenced on the dilatation of the metals: pursuing the comparison between the results of the experiments of Dulong and Petit, with those given by his own instrument. He finds a striking accordance between them in the case of copper, as he had already done with respect to iron and platina. He gives the result of some trials which he made with a view to obtain registers of uniform composition, so as to preclude the necessity of determining the rate of expansion in each individual instance. The results of his experiments on the dilatation of the metals are given in tables; the first showing in arcs of the scales the expansions of four metals from 62° to 212°, and thence to 662° of Fahrenheit; and their respective melting points: and the second, exhibiting the expansion of certain alloys to the same points. The experiments on the melting point of cast iron give a mean of 2768°, and present a remarkable coincidence with the corrected temperature deduced from the expansion of a platina bar, plunged into melted cast iron, which was 2786°; thus affording a conclusive proof of the accuracy of the pyrometer, and of its competency to determine fixed and comparable points of very high temperature. The author accordingly thinks himself warranted in recommending the introduction of the instrument extensively in all arts and manufactures, where it is an object to regulate high temperatures, and where it is calculated to determine many questions of the highest importance both to practical and theoretical science.

Two papers were read; the one entitled, "On the Influence of Screens in arresting the Progress of Magnetic Action:" the other, "On the Power of Masses of Iron to control the attractive Force of a Magnet." By William Snow Harris, Esq. F.R.S.

The object of the first paper is to show that every substance susceptible of magnetism by induction, when interposed as a screen, tends to arrest the action of a magnet upon a third substance: this intercepting power being directly as the mass and inversely as the susceptibility to induced magnetism. Thus, although a single plate

of iron, about the sixteenth of an inch thick, effectually intercepts the action of a revolving magnet on a disc of copper, the same result is not obtained when the disc acted upon is also of iron, instead of being of copper; unless the mass of iron interposed be very considerable. The screening influence he found to depend on the mass of iron that is interposed, and not on the surface merely. He was led to suspect that a similar effect might be obtained by employing substances not of a ferruginous nature, provided they were interposed in considerable masses, and the result of his trials justified his conjecture. An account is given of several experiments made with large masses of silver, copper, or zinc, of about four inches in thickness, which being interposed between a revolving magnetic plate and a delicately suspended disc of tinned iron, completely intercepted the action of the magnet on the iron.

The author considers this interceptive property to be more or less common to every class of substance; and that in order to render it sensible, it is only necessary to employ the bodies in masses, bearing some direct ratio to their respective magnetic energies. Thus lead, having a weaker magnetic energy than copper, must be employed in a larger mass in order to produce an equal effect; and to render the screening power of ice sensible would require it to be above thirty feet in thickness. If, instead of interposing the screen of iron immediately between the revolving magnet and the suspended disc of copper, the iron be brought very near the under surface of the magnet, a similar neutralizing influence is exerted.

In the second paper, the investigation of this subject is resumed, and the neutralizing power of a mass of iron investigated under different circumstances. From the experiments detailed by the author, he is led to infer that substances highly susceptible of receiving transient magnetism, are the most efficient in their operation as screens; this operation being referrible to their neutralizing power. It is, however, very difficult to render this power sensible in the case of non-ferruginous bodies, unless they be actually placed between the magnet and the substance acted upon, so as to neutralize effectually the actions of those points which are nearest to each other. The attractive force exerted between a magnet and a mass of iron he finds to be always in the direct ratio of this controlling or screening power of the iron, or, in other words, to its neutralizing power in similar circumstances.

The author suggests that a temporary magnetic state may be conceived to be induced in a substance in two ways: either by the immediate action of the magnet upon each individual particle of the given substance, or else by the action of each particle of that substance on the next in succession, producing a propagation of magnetism from the one to the other. It may also, however, take place in both these ways at the same time. But these different modes of action appear to be in some inverse ratio of each other: for when the retentive or absorbing power of the substance is considerable, the power of the magnet becomes soon controlled; because the particles of the substance first acted upon, begin to operate as screens

to the succeeding ones, and the induced magnetism after a certain point, proceeds entirely by communication from particle to particle, until the whole power is expended. When, on the contrary, the retentive power of the given substance is small, little or no screening energy exists between its particles, in which case the magnetic excitement will depend upon the influence of the magnet on each individual particle: hence it is only by the succession or multiplication of effect resulting from a great number of particles, that we at length render the controlling power of such a substance sensible. The diminished action of a magnet on a disc of copper, when intersected by radiating grooves, seems to be owing to this cause, since a portion of the substance, requisite to the full development of the magnetic energy, is removed. In confirmation of this reasoning it was found that the number of oscillations of a delicately suspended bar, made in vacuo, in a given arc, surrounded by a mass of copper formed into rings, did not sensibly differ when, in the one case, that mass was made up of concentric rings, and, in the other, was entirely solid: while, on the contrary, by removing a very thin external lamina from the former, the number of vibrations was sensibly changed.

The concluding part of this paper is occupied by speculations on the nature of magnetic action: the author being disposed to regard a magnet as rather in a passive than an active state, when exhibiting the phenomena of magnetic attraction. This attraction he considers as the result of an impression first made on the magnet by the iron which appears to be attracted by it: because he finds that with different masses of iron of the same quality, the force at the same distance is unequal; being with some pieces very sensible, whilst with others it is altogether inappreciable. He views a magnet as a substance put into a peculiar state or condition, in consequence of which it exhibits certain properties when subjected to external excitation; in a way analogous to the elastic force of a spiral spring, which is not called into action unless that spring is stretched by a weight suspended to it, or by some other extraneous force. In the case of magnetism, the exciting substance is likewise affected in a similar manner with the magnet which it excites; and the analogy of the spiral spring may be further pursued, in order to render the two cases corresponding, by supposing the weight which elongates the first spring to be itself another similar spiral spring, which is also elongated while exerting its force on the first. Under these circumstances the separation of the coils will be greatest at the upper end of the whole combination of springs, at least at the lower part, presenting a contrariety of states at the two extremities, analogous to the opposite polarities of the two ends of a magnet.

A paper was read, "On the Atmosphere of Mars." By Sir James South, F.R.S.

The author refers the origin of the hypothesis of the "Extensive Atmosphere of Mars" to the observations of Cassini and Rœner, made at Briare and Paris in the year 1672. By the former it would